ME-7166 Vol 5 of 5

ME-7166

INSTRUCTION MANUAL

MS-2

UHF PULSE SOURCE

ME-7166 Vol 5 of 5

tau-tron

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MS-2

UHF PULSE SOURCE

ME-7166 Vol 5 of 5

High-Speed Digital Instrumentation

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INTRODUCTION

The Tau-Tron Model MS-2 UHF Pulse Source provides stable, digital clock pulses, adjustable from 1 Hz to 300 MHz, for general-purpose system timing. With its array of features, the MS-2 offers versatility as a basic clock source in the Tau-Tron Modular Instrument series.

Two output frequencies are provided: FO, The VCO output, variable from 100 MHz to 300 MHz; and FN, a digitally selected division of FO, variable from 1 Hz to 100 MHz. Dual output connectors are available for both the FO FUNDAMENTAL and the FN FREQUENCY RANGE.

The MS-2 operates in three modes. In the internal (INT) mode, the MS-2 uses its own VCO as a frequency source; the FO and FN frequencies are selected by four controls.

In the external (EXT) mode an externally applied signal is accurately divided down by the FN Range Switches and available at the FN outputs.

In the cyrstal (XTAL) mode (optional), the frequency source is an internal crystal oscillator.

In addition to these modes, a gate input is provided to control the FN outputs.

SPECIFICATIONS

FREQUENCY

Internal (FN)---1 Hz to 100 MHz. Sub-frequency selection of FO in three ranges and up to six sub-multiple steps each.

Internal (FO)---100 MHz to 300 MHz, in two ranges.

External---1 Hz to 100 MHz.

XTAL (Option)---100 MHz maximum.

EXTERNAL IN

One volt p/p minimum amplitude, 5 ns width minimum. 50 ohm input impedance. 5 volt p/p maximum amplitude; maximum +3v pulse top.

GATE INPUT

Standard levels. 50 ohm input impedance. Minimum width 5 ±1 ns.

OUTPUT

FO Output---2 BNC connectors. 1.5 volts min.from 100 - 200 MHz.
1.0 volts min. from 200 - 300 MHz.

FN Output---2 BNC connectors. Standard output. Width 50% of selected period, except 33% pulse width for the 10-30 MHz and 30-100 MHz ranges.

OPTION

Crystal Frequency.

STANDARD TMI SIGNALS

Logical Zero---Between -200 mv and +600 mv.

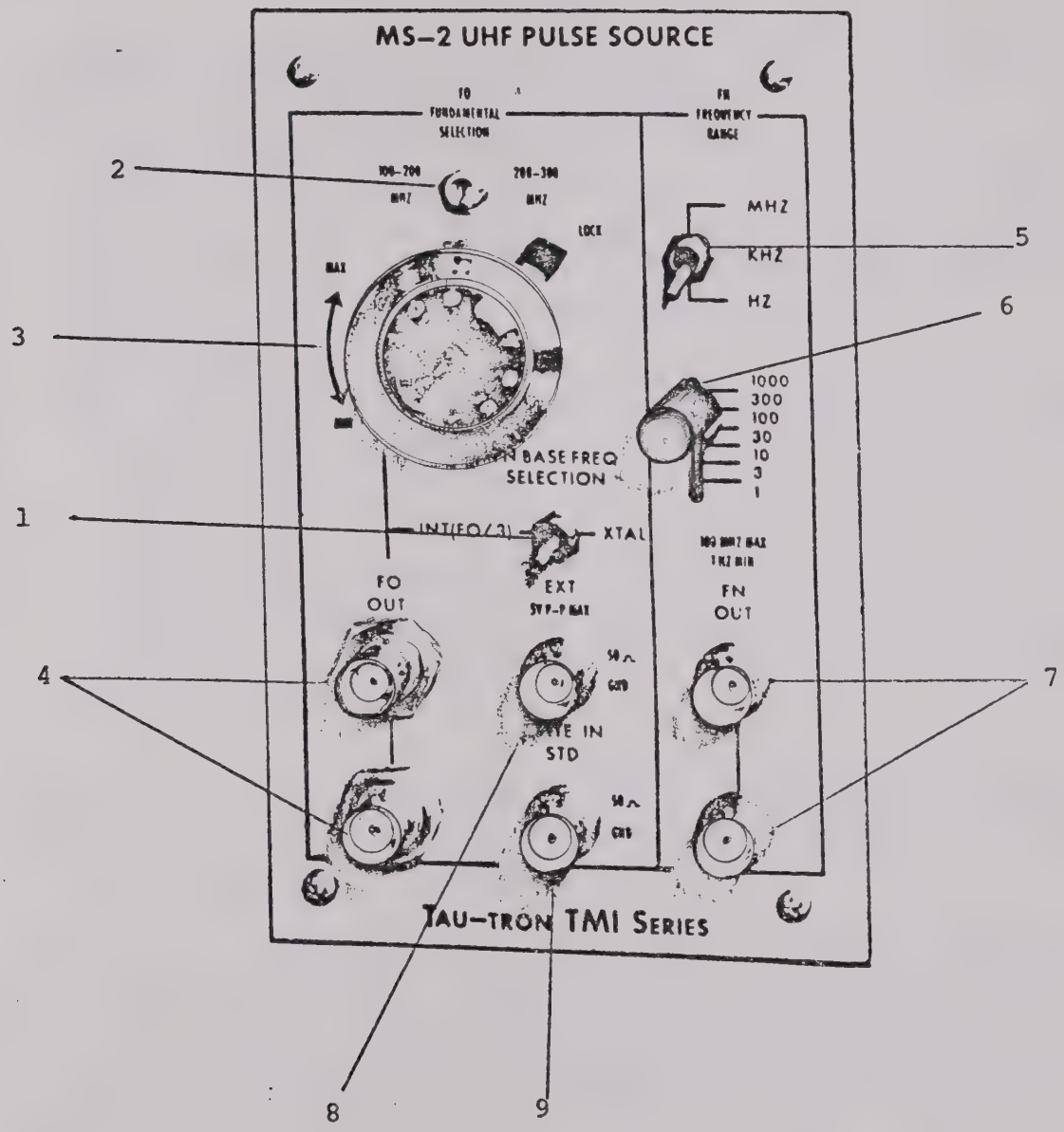
Logical One---More positive than 1.7 volts.

Standard Amplitude---2.0 volts typical.

Transition Edges---Typically 2 ns, 3.5 ns maximum.

Impedance---50 ohms to system ground.

Waveshape Distortion---Less than ±7%, terminated.


MS–2 UHF PULSE SOURCE
FO
FUNDAMENTAL
SELECTION
FN
FREQUENCY
RANGE
MHZ
KHZ
HZ
1000
300
100
30
10
3
1
BASE FREQ
SELECTION
INT(FO/3)
XTAL
EXT
FO
OUT
FN
OUT
STD
TAU–TRON TMI SERIES
1
2
3
4
5
6
7
8
9

OPERATING INSTRUCTIONS

Front Panel Controls

1. Source Selection Switch---Any of three frequency source modes may be selected for the FN Base frequency:
   a. Internal (INT)---When the INT (FO/3) mode is selected, the MS-2 uses its internal voltage controlled oscillator (VCO), divided by 3, as the FN Base Frequency. FN output frequencies, from 1 Hz to 100 MHz, may be selected by adjusting the FN FREQUENCY RANGE switches in combination with the FO FUNDAMENTAL controls.
   b. External (EXT)---The EXT position enables the external input. A clock signal applied to EXT IN is the FN Base Frequency. A selected division of the input frequency appears at the FN outputs.
   c. Crystal (XTAL)---When the MS-2 is equipped with the optional crystal, the XTAL position engages the internal crystal as the FN Base Frequency. A selected division of the crystal frequency is present at FN.

2. FO Range---The FO FUNDAMENTAL Frequency range is selected by a front panel toggle switch that provides a FO output in either a 100-200 MHz range or a 200-300 MHz range.

3. FO Vernier---This ten-turn vernier control dial ensures precise selection of frequency. The dial locks to prevent any accidental frequency change. The FO outputs will always be between 100 MHz and 300 MHz; they will not be affected by the FN FREQUENCY RANGE switches.

4. FO Outputs---The dual FO outputs are at standard TMI signal levels. FO is 100 MHz to 300 MHz, continuously variable in two ranges. The FO outputs provide 1.5 to 3 ns pulses and must be terminated in 50 ohms to ground. FO outputs are the VCO regardless of the FN Base Frequency selected. An unused output should still be terminated by 50 ohms to ground for proper waveshape on the used output.

5. FN Frequency Scale Switch---This toggle switch designates the frequency scale - Hz, KHz, MHz - to be used with the Frequency Range (slide) switch.

6. FN Frequency Range Switch---This six position slide switch is used with the FN Frequency Scale Switch to accurately divide down the FO Frequency in all three operating modes. In the INT (FO/3) mode, each detent specifies a continuous frequency range; fine adjustment is made by rotating the FO vernier control dial while monitoring the FN outputs. Together, these ranges form a total frequency range from 1 Hz to 100 MHz. In the external (EXT) and crystal (XTAL) modes, the vernier control dial does not affect FN, the FN Frequency Range switches together function as a discrete frequency divider. See Table 1.

7. FN Outputs---The dual FN outputs are at standard TMI signal levels. The FN output is a squarewave and must be terminated in 50 ohms to ground. An unused output must still be terminated by 50 ohms to ground for proper signal waveform on the used output.

8. External Clock Input---This BNC input, 50 ohms to ground, will accept a 5v p/p maximum amplitude, +3v maximum pulse top input. It gives the user the ability to accurately divide an input clock frequency; the divided output will appear at FN OUT.

9. Gate Input---This BNC input, accepting standard TMI signals, allows the user to gate the FN outputs on and off, in all three modes of operation. The gating is synchronous with the FN Base Frequency selected. This input is 50 ohms to ground.

TABLE 1

FN FREQUENCY SELECTION

	MHz	kHz	Hz
300 to 1,000	No Output	$\frac{FB}{10^2}$	$\frac{FB}{10^5}$
100 to 300	No Output	$\frac{FB}{3 \times 10^2}$	$\frac{FB}{3 \times 10^5}$
30 to 100	FB	$\frac{FB}{10^3}$	$\frac{FB}{10^6}$
10 to 30	$\frac{FB}{3}$	$\frac{FB}{3 \times 10^3}$	$\frac{FB}{3 \times 10^6}$
3 to 10	$\frac{FB}{10}$	$\frac{FB}{10^4}$	$\frac{FB}{10^7}$
1 to 3	$\frac{FB}{3 \times 10}$	$\frac{FB}{3 \times 10^4}$	$\frac{FB}{3 \times 10^7}$

FB is the FN Base Frequency: either INT (FO/3), or EXT, or XTAL.

TIMING CONSIDERATIONS

INPUTS

Both inputs are asynchronous to the internal logic, and may be applied at any time. EXT will become the clock source (FN Base Frequency) for the FN divider logic, and is therefore "self-synchronizing". GATE IN will be synchronized internally to the selected FN Base Frequency. There will be an ambiguity of one period of the FN Base Frequency from application (or removal) of the GATE IN signal, and its effect upon the FN output.

OUTPUTS

Both FO outputs are typically edge aligned. Both FN outputs are typically edge aligned.

THEORY OF OPERATION

The Tau-Tron Model MS-2 UHF Signal Source can provide a clock signal for equipment operating from less than 1 Hz to 300 MHz. This is accomplished by providing two simultaneous output frequencies: the fundamental VCO output (FO) covers the 100 MHz to 300 MHz band, and the sub-multiple output (FN) covers the frequencies up to 100 MHz.

FO Voltage Controlled Oscillator

The UHF VCO is located on a separate PC board from the FN frequency division logic. It actually consists of two VCO's due to the very wide bandwidth required. Only one VCO is powered at any time via a front panel FO range selection. Both VCO's are identical except for the tank circuit components: one covers the range from 100 MHz to 200 MHz, the other covers the range from 200 MHz to 300 MHz. A front panel ten-turn potentiometer provides precise adjustment of the control voltage over the frequency range selected.

The output of the selected VCO is amplified on the UHF board to provide essentially fixed width pulse outputs (two) driving a 50 ohm external load. Typical pulse width is 1.5 ns at 300 MHz to 3.0 ns at 100 MHz. A divide-by-3 logic circuit prescales the 100 MHz to 300 MHz frequency range of the UHF oscillator down to 33 MHz to 100 MHz for compatibility with the FN frequency division logic.

FN Frequency Division Logic

The frequency source for the FN frequency division logic can be selected via front panel switch to be 1/3 the FO frequency, the optional crystal oscillator, or the external input. A divide-by 3 prescaler and seven decade stages comprise the digital frequency divider circuits. Either the selected frequency source, or the selected source prescaled by the divide-by-three logic is selected as the input to the decade divider chain.

The first decade stage is actually broken down into a divide-by-five and divide-by-two sections. The six remaining decades are driven from the divide-by-5 section, while the selected output stage always passes through the divide-by-2 section. This insures a squarewave output from the decade divider logic.

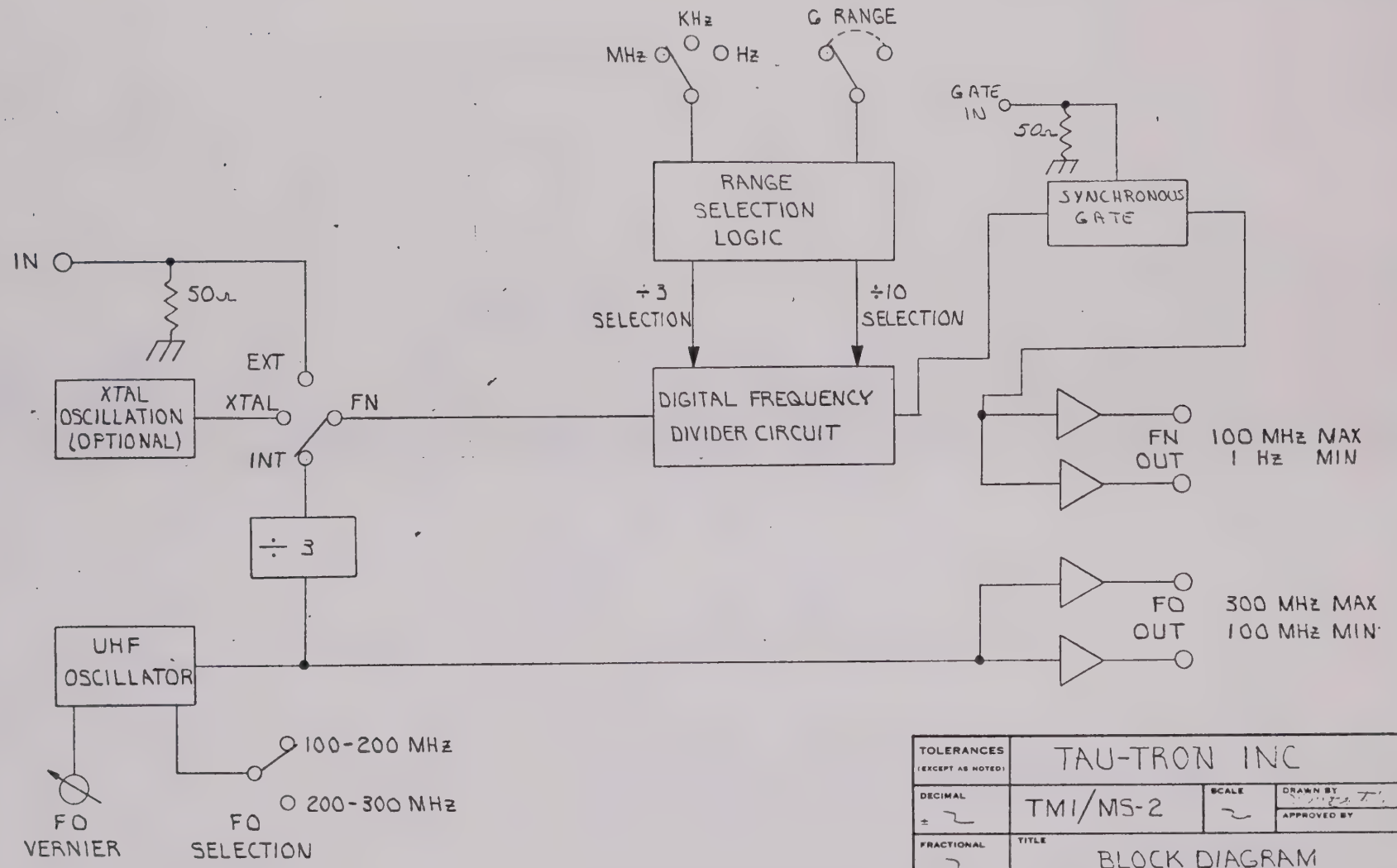
Selection of FN output frequency via the MHz/KHz/Hz range switch and the six-position 1-1000 range switch is decoded to select the decade divider input and the proper output stage for the desired FN frequency range. At the 10-30 MHz and 30-100 MHz selections, the decade divide input drives the output amplifier.

A gate input is provided to allow disabling of the output signal. It is synchronized by receiving the gate input into a latch clocked by the selected output frequency. This synchronizes the enabling/disabling of the output amplifier to the falling edge of the FN signal. When disabled, the FN outputs are forced to a low level.

LIST OF ILLUSTRATIONS

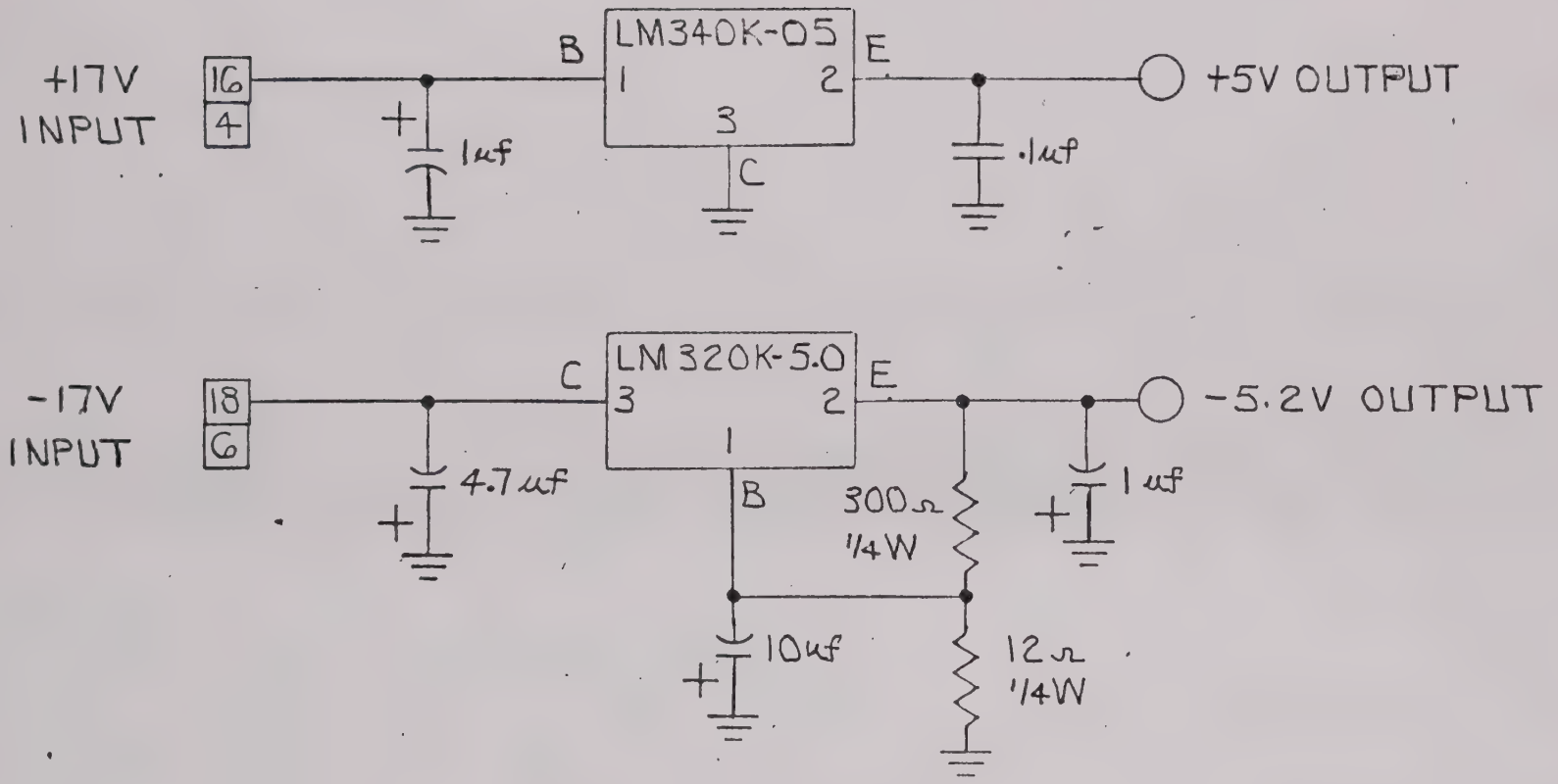
MS-2 Block Diagram. TBN-53348
Module Power Supply TAJ-53382
UHF Oscillator Schematic. TCJ-53324
VHF Oscillator Schematic. TDJ-53922

DATE	SYM	REVISION RECORD	DR	CK
		ECI # 1233		



TOLERANCES (EXCEPT AS NOTED)	TAU-TRON INC		
DECIMAL ± ~	TM1/MS-2	SCALE ~	DRAWN BY J. T.
FRACTIONAL ± ~	TITLE BLOCK DIAGRAM		APPROVED BY
ANGULAR ± 2°	DATE 8-28-74	DRAWING NUMBER TBN-53348	EC 1 / 1

BRUNING 40-21



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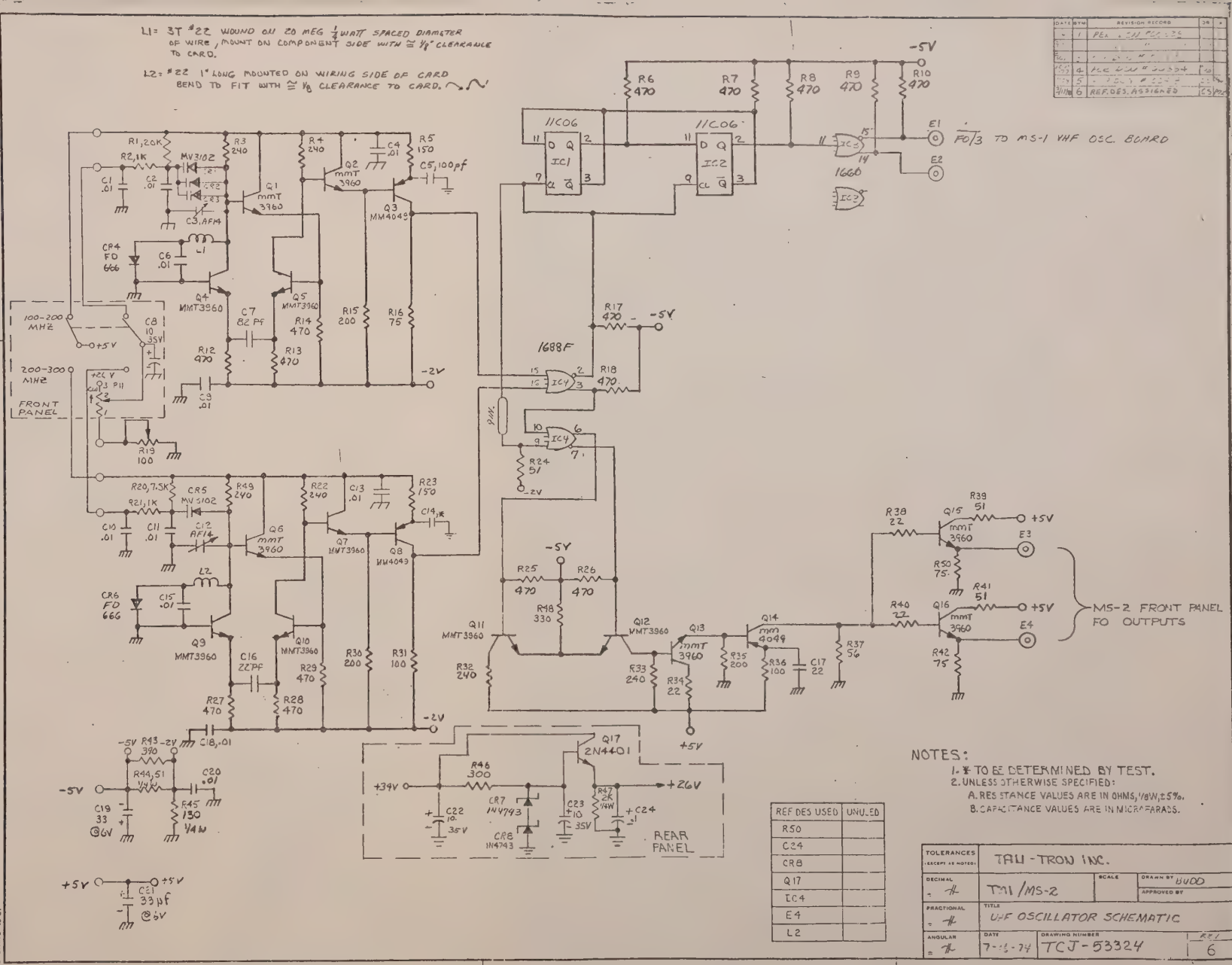
DECIMAL ± ———	TMI SERIES	SCALE ———	DRAWN BY APPROVED BY
FRACTIONAL ± ———	TITLE SCHEMATIC MODULE POWER SUPPLY (±5V)		
ANGULAR ± ———	DATE 11/5/74	DRAWING NUMBER TAJ-53382	

BRUNING 40-21



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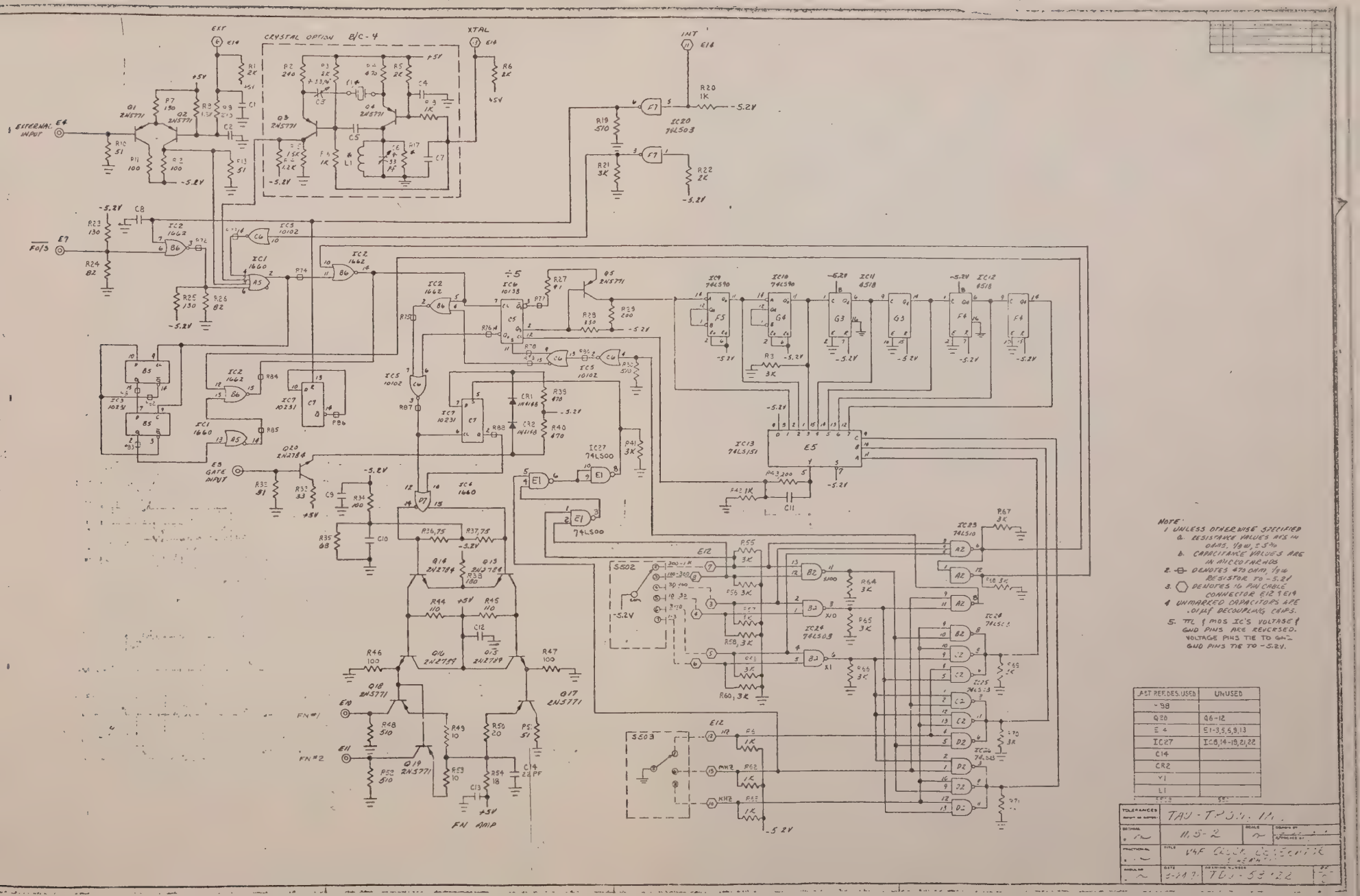
[illegible]	[illegible]	[illegible]	
[illegible]	4	[illegible]	
[illegible]	5	[illegible]	
3/11/74	6	REF. DES. ASSIGNED	CS/PC

NOTES:
1. * TO BE DETERMINED BY TEST.
2. UNLESS OTHERWISE SPECIFIED:
   A. RESISTANCE VALUES ARE IN OHMS, 1/8W, ±5%.
   B. CAPACITANCE VALUES ARE IN MICROFARADS.

REF DES USED	UNUSED
R50	
C24	
CR8	
Q17	
IC4	
E4	
L2	

TOLERANCES (EXCEPT AS NOTED):	TAU-TRON INC.		
DECIMAL ±	TM1/MS-2	SCALE	DRAWN BY BWOO / APPROVED BY
FRACTIONAL ±	TITLE: UHF OSCILLATOR SCHEMATIC		
ANGULAR ±	DATE 7-15-74	DRAWING NUMBER TCJ-53324	REV 6

BRUNING 40-21



NOTE:
1. UNLESS OTHERWISE SPECIFIED
   a. RESISTANCE VALUES ARE IN OHMS, 1/4W, ±5%
   b. CAPACITANCE VALUES ARE IN MICROFARADS
2. ⊖ DENOTES 470 OHM, 1/4W RESISTOR TO −5.2V
3. ⬡ DENOTES 16 PIN CABLE CONNECTOR E12 TO E14
4. UNMARKED CAPACITORS ARE .01μF DECOUPLING CAPS.
5. TTL & MOS IC'S VOLTAGE & GND PINS ARE REVERSED. VOLTAGE PINS TIE TO GND. GND PINS TIE TO −5.2V.

LAST REF DES USED	UNUSED
Y98	
Q20	Q6-12
E 4	E1-3,5,6,9,13
IC27	IC8,14-19,21,22
C14	
CR2	
Y1	
L1	

TOLERANCES	TAU-TRU. INC.		
DECIMAL	11,5-2	SCALE	DRAWN BY
FRACTION	TITLE VHF CHAN. OSCILLATOR & TIMING		APPROVED BY
ANGULAR	DATE 5-11-71	DRAWING NUMBER 761-5322	SH

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INSPECTION

1. MECHANICAL

If any damage is observed on the shipping carton, ask that the carrier's agent be present during unpacking. In the event that any external damage is found on the instrument, notify the carrier and Tau-Tron as soon as possible. Follow claims procedure below.

2. ELECTRICAL

Check out the electrical performance of the instrument as soon as possible after receipt. Should any malfunctions be observed, follow the claims procedure below.

3. CLAIMS

If the unit has mechanical damage or fails electrical check-out, notify Tau-Tron immediately. For mechanical damage which occurred during shipment, notify the carrier also. The Tau-Tron Customer Service Department will arrange for repair or replacement of the instrument. A Return Authorization number will be issued for all returns.

4. REPACKAGING

Use the original shipping carton and materials, if available. Otherwise use a double-walled carton (test strength of 350 pounds), and shock absorbing material such as bubble-wrap to prevent instrument from moving in the shipping carton during transit. Secure package by sealing with heavy paper tape.